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Australian schoolgirl a science sensation

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Aussie teen's wheelchair breakthrough

Quadruplegics speaking any language will be able to use a voice-controlled wheelchair designed by 16-year-old Hobart student, Yaya Lu.

An Australian teenager's simple idea that would allow a complete quadriplegic to control a wheelchair by voice has earned her international recognition and a top science award for school students, handed out by Commonwealth science agency CSIRO.

Yaya Lu, 16, of Hobart, has her mind set on helping the disabled through technology and has just arrived back home after presenting a research paper about her wheelchair to the 5th Biomedical Engineering International Conference in Bangkok.

“The paper Yaya was presenting was for an international conference, which normally accepts papers from post-graduate students or university lecturers.”

Yaya's mentor, neighbour and a former university lecturer Dr Graeme Faulkner

She was able to present her findings to the conference in Thailand after Google sponsored her and her mother's trip.



Yaya presents her findings to a conference in Bangkok. Inset, a prototype of her wheelchair. Photo: Ying Chen

Yaya was recently awarded the Gold CREST Award by the CSIRO, which is only given to a select few students each year and requires original ideas and more than 100 hours of work to enter. As part of her submission for the award she put together a 60-page report, showed prototypes, a video and participated in a verbal examination.

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The high school student — who said presenting her findings to about 30 academics in Bangkok was "nerve-racking" and "quite intimidating" — used the Lego Mindstorms NXT robotics kit to demonstrate how her robot would work in reality.

The robot makes use of language-independent voice commands by using a combination of short and long sounds (like "dit" and "dah"). It can use eight commands, allowing it to move forwards and backwards, spin clockwise and anti-clockwise, move sideways left and right, and stop. An eighth command could toggle it to rise and fall.



Yaya, second from right, meets Prime Minister Julia Gillard. *Photo: Ogilvie High School*

Yaya said she first decided to start on the project in 2012 when she heard about a complete quadriplegic from northern Tasmania who, like most quadriplegic people, couldn't move any part of his body below his neck. "So I kind of thought I could develop a system that could help a quadriplegic like him gain more independence in their daily life," Yaya said.

Two control systems were investigated which Yaya thought might help the man control a wheelchair.

The first involved using various parts of the face to control a wheelchair, like using movement of the ears, dilation of the nostrils and movement of the eyebrows. The second focused on language-independent voice commands for control, which Yaya said she created for people who were unable to move their facial features in a certain way for the first system to work.

The beauty of the language-independent voice controlled wheelchair design, Yaya said, was that it wasn't based on voice recognition, which takes a long time to get working correctly, costs lots of money and uses a lot of computing power.

"You have to download different software, you have to test it out and it can be difficult to use not to mention take a while to train," Yaya said. "There is Dragon Naturally Speaking, which is a sort of voice typing software. You have to train it to get used to your voice and it is very, very difficult. It takes a very long time, not to mention you need extremely powerful [central processing units] to be able to make it work and I think it's just extremely expensive and not very convenient at all."

Other control systems, such as one which uses a magnet glued to the tongue, were "very intrusive", Yaya said.

"You want to be able to eat, you want to be able to speak normally without that magnet glued to you."

Another that harnesses the eye by scanning it, Yaya said, "could hurt your eyes in the future".

"That's why the two control systems I've proposed are... more comfortable for the [wheelchair user]."

Yaya's mother, Yin, an information systems lecturer at the University of Tasmania, said she was "blown away" by what her daughter had achieved. "It's really marvellous. I'm really pleased with her. Yaya has really done a lot and put in a lot of effort."

Yaya's mentor, neighbour and a former university lecturer with a PhD in artificial intelligence, Dr Graeme Faulkner, said what Yaya had achieved was "remarkable".

"The paper Yaya was presenting was for an international conference, which normally accepts papers from post-graduate students or university lecturers," Dr Faulkner said. "And I suppose it may have happened before but I've never heard of a Year 10 student presenting one who has had to ask for leave from school to attend.

"It just doesn't happen, at least to my knowledge in my half-century of academic experience."

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